Claims

What is claimed is:

1. A method for filtering an optical signal, comprising:

directing an input optical signal into an optical resonator configured to support whispering gallery modes and comprising a portion where the whispering gallery modes are present, wherein at least the portion of the optical resonator exhibits an electro-optical effect;

coupling light out of the optical resonator to produce a filtered optical output from the input optical signal; and

applying an electrical control signal to at least the portion in the optical resonator to tune a spectral transmission peak of the optical resonator and thus to select spectral components in the input optical signal in the filtered optical output.

2. The method as in claim 1, further comprising using TM modes in whispering gallery modes when coupling the input optical signal into the optical resonator and coupling light out of the optical resonator.

3. The method as in claim 1, further comprising using at least one portion of nonspherical geometry as the optical resonator to support the whispering gallery modes.

4. The method s in claim 3, wherein the nonspherical geometry is a spheroid.

5. The method as in claim 3, further comprising using at least one portion of a sphere as the optical resonator.

6. The method as in claim 1, further comprising using a disk resonator as the optical resonator.

7. The method as in claim 1, further comprising:

receiving an input electrical signal carrying multiple signal channels;

optically modulating an optical beam with the input electrical signal to produce a modulated optical signal as the input optical signal which carries the multiple signal changes as the signal;

tuning the spectral transmission peak of the optical resonator to transmit a selected signal channel in the filtered optical output while optically rejecting other signal channels;

converting the filtered optical output into an electrical signal; and

extracting the selected channel from the electrical signal.

8. The method as in claim 1, further comprising:

splitting a unmodulated optical beam into first and second beams;

modulating the first beam as the input optical signal;

directing the second beam through an optical delay path;

combining the filtered optical output and the second beam after the optical delay path to produce a combined optical signal;

converting the combined optical signal into an electrical signal; and

extracting the signal from the electrical signal.

9. The method as in claim 1, further comprising using TE modes in whispering gallery modes when coupling the input optical signal into the optical resonator and coupling light out of the optical resonator.

10. A tunable optical filter, comprising:

an optical resonator configured to support whispering gallery modes and comprising at least a portion where the

whispering gallery modes are present, wherein at least the portion of the optical resonator exhibits an electro-optical effect;

at least one electrode formed on the optical resonator to guide an electrical control signal into the optical resonator to spatially overlap with the whispering gallery modes; and

a control unit coupled to the at least one electrode to supply an electrical control signal to the one portion to tune a refractive index and thus a transmission peak of the optical resonator via the electro-optical effect.

11. The filter as in claim 10, wherein said tunable optical resonator includes a lithium niobate crystal.

12. The filter as in claim 10, further comprising an optical coupler that is evanescently coupled to the optical resonator.

13. The filter as in claim 12, wherein the optical coupler is a fiber coupler.

14. The filter as in claim 12, wherein the optical coupler includes a waveguide.

15. The filter as in claim 12, wherein the optical coupler includes a photonic gap material.

16. The filter as in claim 12, wherein the optical coupler includes a prism.

17. A device, comprising a receiver to receive a radiation signal carrying a plurality of signal channels and to extract a selected channel from the received signal channels, wherein the receiver comprises:

an optical modulator to modulate an optical beam in response to the radiation signal to produce a modulated optical signal carrying the signal channels,

a tunable optical filter having (1)an optical resonator which is configured to support whispering gallery modes and comprise at least a portion where the whispering gallery modes are present, wherein at least the portion of the optical resonator exhibits an electro-optical effect, (2) at least one electrode formed on the optical resonator to guide an electrical control signal into the optical resonator to spatially overlap with the whispering gallery modes, and (3)a control unit coupled to the at least one electrode to supply an electrical control signal to the one portion to tune a refractive index and thus a transmission peak of the optical resonator via the electro-

optical effect, wherein the optical filter is located to receive and filter the modulated optical signal to produce a filtered optical output that carries only the selected signal channel,

an optical detector to convert the filtered optical output into an electrical signal, and

a mixer that mixes the electrical signal with a reference signal to extract the selected signal channel.

18. The device as in claim 17, wherein said tunable optical resonator includes a lithium niobate crystal.

19. The device as in claim 17, further comprising an optical coupler that is evanescently coupled to the optical resonator.